CLAIMS

What is Claimed is:

1. A method for performing time domain reflectometry on a communication channel comprising:

generating an maximal length sequence signal;

transmitting the sequence signal over a communication channel;

receiving a reflection signal from the communication channel in response to the transmitting of the sequence signal;

correlating the reflection signal with the sequence signal to generate a correlated signal;

retrieving a template signal;

aligning the template signal and the correlated signal to determine a point of alignment;

subtracting the template signal from the correlated signal to remove near-end echo from the correlated signal;

measuring a time interval between the point of alignment and a subsequent peak in the correlated signal; and

multiplying the time interval by the rate of propagation of the sequence signal through the communication channel to obtain distance information regarding a line anomaly.

2. The method of Claim 1, wherein the template signal is a correlated version of a reflection created by a line interface.

3. The method of Claim 1, wherein a subsequent peak in the reflections signal is caused by a bridge tap.

4. The method of Claim 1, wherein the communication channel comprises a twisted pair conductor.

5. The method of Claim 1, wherein transmitting the sequence signal is at a power level that does not introduce crosstalk into other communication channels.

6. The method of Claim 1, further including performing a circular rotation of the sequence signal to create a rotated sequence signal;

transmitting the rotated sequence signal over the communication channel;

receiving a rotated reflection signal;

correlating the rotated reflection signal with the rotated sequence signal to create a rotated correlated signal;

aligning the rotated correlated signal with the correlated signal; and

adding the rotated correlated signal to the correlated signal to reduce or remove correlation artifacts on the correlated signal.

7. A method for performing sequence time domain reflectometry comprising:

transmitting a sequence signal through a channel;

receiving a reflected sequence signal; and

processing the reflected sequence signal to determine the location of at least one impedance mismatch on the channel.

8. The method of Claim 7, wherein processing comprises correlation of the reflected sequence signal with the sequence signal.

9. The method of Claim 7, wherein processing comprises processing coefficients of a prediction filter.

10. The method of Claim 7, wherein at least one impedance mismatch is created by a load coil.

11. The method of Claim 7, wherein the sequence signal comprises a maximal length sequence.

12. The method of Claim 7, further including the step of removing unwanted reflections of the reflected sequence signal by subtracting a template signal

from the reflected sequence signal or a processed version of the reflected sequence signal.

13. The method of Claim 12, further including the step of removing correlation artifacts from a correlated version of the reflected signal by combining a rotated correlated sequence signal with the correlated version of the reflected signal.

14. A method for processing a reflection signal resulting from transmission of a sequence of bits over a channel to determine the location of one or more line anomalies comprising:

providing the sequence of bits transmitted over the channel to a prediction module;

processing the sequence of bits in the prediction module based on coefficient values of the prediction module to generate a prediction module output;

comparing the prediction module output to a reflection signal; and

modifying the coefficient values, based on the comparing, to cause the prediction module output to generally resemble the reflection signal.

15. The method of Claim 14, further including analyzing the coefficient values when the prediction module output generally resembles the reflection signal to determine the location of one or more impedance mismatches on the channel.

16. The method of Claim 15, wherein the prediction module comprises a finite impulse response filter.

17. The method of Claim 14, wherein the sequences of bits comprises a sequence selected from the group of sequences consisting of a maximal length shift register sequence, a Barker code, and a Kasami sequence.

18. The method of Claim 14, wherein comparing comprises subtracting the prediction filter output from the reflection signal.

19. The method of Claim 14, wherein the one or more line anomalies are selected from the group consisting of load coils, bridge taps, line terminations, moisture, and impedance mismatch.

20. The method of Claim 14, wherein the channel comprises a twisted pair conductor.

21. A method for processing reflection to determine the location of line anomalies in a communication channel comprising:

correlating the reflection with a sequence signal to create a correlated signal, the sequence signal comprising a sequence signal transmitted to generated the reflection;

locating a signal component in the correlated signal indicative of an impedance mismatch;

calculating a time period between the beginning of the reflection and the signal component; and

multiplying the time period by one-half the rate of propagation of the reflection through the communication channel to determine the distance between one end of the communication channel and the impedance mismatch.

22. The method of Claim 21, wherein the channel comprises a twisted pair conductor configured for communication based on a digital subscriber line standard.

23. The method of Claim 21, wherein correlating comprises cross-correlation using a sliding tapped delay line.

24. The method of Claim 21, further including adding a correlated version of a rotated version of the sequence signal whereby adding reduces correlation artifacts of the correlated signal.

25. The method of Claim 21, wherein the method is at least partially embodied in software in a modem.

26. A method for processing a reflection signal generated by transmission of a test signal onto a channel to determine a location of a line anomaly comprising:

correlating the reflection with the test signal to create a correlated reflection signal

analyzing the correlated reflection signal to determine a time difference between transmission of the test signal and a point of correlation;

multiplying the time difference by the rate of propagation of the test signal through the channel to obtain information regarding the location of a line anomaly.

27. The method of Claim 26, wherein analyzing comprises determining a time difference between receipt of near-end echo of the correlated reflection signal and a peak in the correlated reflection signal.

28. The method of Claim 26, wherein the method is performed by an integrated circuit that is part of a data communication device.

29. The method of Claim 26, wherein the test signal is a sequence signal with good autocorrelation properties.

30. The method of Claim 26, further including:

subtracting a template signal from the reflection signal or the correlated reflection signal to more clearly define a point of correlation; and

adding a rotated signal to the correlated reflection signal to reduce correlation artifacts, wherein the rotated signal comprises a signal resulting from correlating a rotated test signal with a reflection of a rotated test signal.

31. A method for generating a signal for performing a time domain reflectometry analysis comprising:

providing a sequence identifier to a sequence generator;

inputting a generation signal into the sequence generator, the generation signal based on the sequence identifier; and

processing the generation signal to generate a sequence signal, the sequence signal to be used for time domain reflectometry.

32. The method of Claim 31, wherein the sequence identifier comprises information regarding the period of the sequence.

33. The method of Claim 30, wherein the sequence identifier further comprises information about the sequence repetition number.

34. The method of Claim 31, wherein the sequence signal comprises a maximal length shift register sequence, which is generated with a linear feedback shift register.

35. The method of Claim 31, wherein the sequence signal, when correlated with itself, generates points of correlation with magnitude greater than the points of non-correlation.

36. The method of Claim 31, wherein the sequence signal has a power level, which conforms to standards for digital subscriber loop communications.

37. The method of Claim 31, further including generating a rotated sequence signal wherein the rotated sequence comprises a circularly rotated version of the sequence signal.

38. The method of Claim 31, wherein the sequence generator comprises a scrambler.

39. The method of Claim 31, wherein the sequence generator comprises computer readable medium storing software code and a processor configured to read a sequence from the computer readable medium.

40. A system for performing sequence time domain reflectometry to determine the location of impedance mismatches on a channel being configured to communicate data using a digital subscriber line standard, the system comprising:

a sequence generator configured to generate a sequence signal;

a transmitter configured to transmit the sequence signal on a channel causing the sequence signal to propagate through the channel, the channel being analyzed to determine the location of impedance mismatches that may affect data transmission;

a receiver configured to receive one or more reflections that result from the sequence signal encountering impedance mismatches as it propagates through the channel;

a correlator configured to correlate the one or more reflections with the sequence signal to generate an output having one or more peaks;

a processor configured to:

time the period between a beginning of the sequence signal transmission by the transmitter and at least one of the one or more peaks; and

calculate a value corresponding to a channel length between the system and an impedance mismatch.

41. The system of Claim 40, wherein the system is embodied in conjunction with a communication device configured to communicate data using a digital subscriber line standard

42. The system of Claim 40, wherein the sequence generator comprises a tapped delay line.

43. The system of Claim 40, wherein the channel comprises a channel selected from the group consisting of twisted pair conductor and fiber optic cable.

44. The system of Claim 40, wherein the correlator comprises a tapped delay line.

45. A system for performing time domain reflectometry on a communication channel to provide information regarding a location of a line anomaly comprising:

sequence generator configured to generate a sequence signal;

a transmitter in communication with the sequence generator and configured to transmit the sequence signal onto the channel;

a receiver configured to receive signals from the channel and provide the signals to a reflection processor; and

a reflection processor configured to process the reflection to determine a location of a line anomaly.

46. The system for Claim 45, wherein the communication channel comprises twisted pair wire.

47. The system for Claim 45, wherein the peak voltage of the sequence signal is less than 18 volts.

48. The system for Claim 45, wherein the reflection processor includes a correlation unit.

49. The system for Claim 45, wherein the system is integrated with a data communication device.

50. A system for processing a reflection signal received in response to transmission of a sequence signal over a channel comprising:

a correlator configured to correlate the reflection signal with the sequence signal to generate a correlated signal;

a peak detector configured receive the correlated signal and detect a start of the correlation signal and a subsequent peak; and

a timer configured to determine a difference in time between a start of the correlation signal and the subsequent peak, wherein the difference in time can be related to a distance between an end of the channel and a line anomaly.

51. The system of Claim 50, wherein the start of the correlation signal is defined by a peak in the correlated signal caused by a reflection received from a line interface.

52. The system of Claim 50, wherein the peak detector comprises a comparator and a register in which a current peak value is stored.

53. The system of Claim 50, wherein the timer comprises a counter configured to count the samples between the start of the correlation signal and a subsequent peak caused by the echo from a line anomaly.

54. The system of Claim 50, wherein the channel comprises a twisted pair conductor and the sequence signal does not generate disruptive crosstalk in adjacent pairs in a binder that also contains the twisted pair conductor.

55. A system for determining the location of one or more impedance mismatches that affect communication, the system comprising:

a sequence generator configured to generate a sequence signal for transmission on a channel;

a transmitter configured to receive the sequence signal and transmit the sequence signal onto the channel;

a receiver configured to receive a reflection signal from the channel and provide the reflection signal to an impedance mismatch location module;

an impedance mismatch location module comprising:

an adaptive filter having two or more coefficient values associated with the adaptive filter, the coefficient values at least partially determining an output of the adaptive filter;

a comparator configured to compare the output of the adaptive filter with the reflection signal; and

a feedback loop between the comparator and the adaptive filter, whereby feed back received by the adaptive filter via the feedback loop may modify the two or more coefficient values to cause the output of the adaptive filter to generally resemble the reflection signal;

a coefficient analysis system configured to analyze the two or more coefficients to determine the location of one or more impedance mismatches.

56. The system of Claim 55, wherein the sequence comprises a maximal length sequence.

57. The system of Claim 55, wherein the system in associated with a communication device, the communication device configured to transmit and receive data on the communication channel.

58. The system of Claim 55, wherein the coefficient analysis system comprises a peak detector and a timing module.

59. The system of Claim 55, wherein the adaptive filter comprises a finite impulse response filter.

60. An apparatus for processing a reflection signal to determine a location of a line anomaly comprising:

means for receiving a reflection signal from a line;

means for correlating the reflection signal to create a correlated reflection signal; and

means for analyzing the correlated reflection signal to determine the location of one or more line anomalies associated with the line.

61. The apparatus of Claim 60, wherein one or more line anomalies comprise one or more points of impedance mismatch.

62. The apparatus of Claim 60, further including means for subtracting a template signal from the correlated reflection signal.

63. The apparatus of Claim 60, further including means for adding a correlated rotated reflection signal to the correlated reflection signal.

64. The apparatus of Claim 60, wherein the means for correlating and the means for analyzing comprises a processor and processor readable code.

65. A computer program product comprising a computer useable medium having computer program logic recorded thereon for performing time domain reflectometry analysis comprising:

computer program code logic configured to receive one or more reflections of a sequence signal that are caused by the sequence signal encountering impedance mismatches as it propagates through a channel;

computer program code logic configured to correlate the one or more reflections with the sequence signal;

computer program code logic configured to process the correlation to determine a time difference value between transmission of the sequence signal and receipt of one or more reflections; and

computer program code logic configured to process the time difference value with regard to the rate of propagation of the sequence signal and the reflection through the channel to determine information regarding a location of the impedance mismatch.

66. The computer program product of Claim 65, wherein the sequence signal comprises a maximal length sequence.

67. The computer program product of Claim 65, further including computer program product configured to generate a sequence signal, the computer program product comprising:

computer program code logic configured to specify a sequence;

computer program code logic configured to recall the sequence signal from memory; and

computer program code logic configured to provide the sequence signal to a transmitter.

68. The computer program product of Claim 65, wherein the computer program code logic configured to process the correlation comprises a compare routine and a counter.

69. The computer program product of Claim 65, further including computer program code logic configured to recall a template from memory and subtract the template from the correlated signal to remove unwanted portions of the reflection signal.

70. The computer program product of Claim 65, further comprising:

computer program code logic configured to modify the sequence signal;

computer program code logic configured to initiate transmission of the modified sequence signal over the channel;

computer program code logic configured to receive a modified reflection caused by the modified sequence signal;

computer program code logic configured to correlated the modified reflection with the modified sequence signal to create a modified correlation; and

computer program code logic configured to combine the correlation and the modified correlation.